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Characterization of turbulence from a fine-scale parameterization and microstructure measurements in the Mediterranean Sea during the BOUM experiment

One of the main purposes of the BOUM experiment was to find evidence of the possible impact of submesoscale dynamics on biogeochemical cycles. To this aim physical as well as biogeochemical data were collected along a zonal transect through the western and eastern basins of the Mediterranean sea. Along this transect 3 day fixed point stations were performed within anticyclonic eddies during which microstructure measurements of the temperature gradient were collected over the top 100m of the water column. We focus here on the characterization of turbulent mixing.

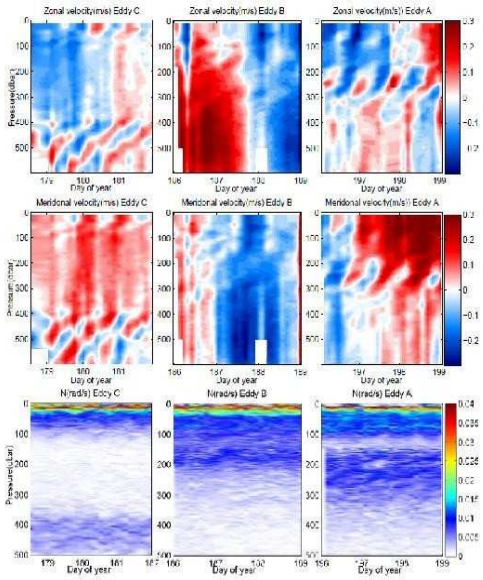

Figure 1: Time depth plots of (a) zonal velocity (b) meridional velocity (c) stratification profiles

The analysis of microstructure measurements revealed a high level of turbulent kinetic energy (TKE) dissipation rate in the seasonal pycnocline and a moderate level below with mean values of the order of 10-6W.kg-1 and 10-8 W.kg-1 respectively. The Gregg Henyey (Gregg 1989) fine-scale parameterization of TKE dissipation rate produced by internal wave breaking, and adapted here following Polzin (1995) to take into account the strain to shear ratio was first compared to these direct measurements with favorable results. The parameterization was then applied to the whole data set. Within the eddies, a significant increase of dissipation at the top and base of eddies associated with strong near inertial waves is observed. Vertical turbulent diffusivity is increased both in these regions and in the weakly stratified eddy core. The stations collected along the East West transect provide an overview of parameterized TKE dissipation rates and vertical turbulent diffusivity over a latitudinal section of the Mediterranean sea. Strong TKE dissipation rate are found within the first 500m and up to 1500 m above the bottom. Close to the bottom where the stratification is weak the inferred vertical turbulent diffusivity can reach Kz~10-3m2.s-1 and may therefore have a strong impact on the upward diffusive transport of deep waters masses.

1. Cuypers, Y., Bouruet-Aubertot, P., Marec, C., Fuda, J.L. Characterization of turbulence and validation of a fine-scale parametrization in the Mediterranean Sea during the BOUM experiment Biogeosciences Discuss., 8, 8961–8998